

CLAIMS

1. A III-nitride compound semiconductor light emitting device including an n-type III-nitride semiconductor layer, an active layer made of III-nitride semiconductor and deposited over the n-type III-nitride semiconductor layer, a
5 p-type III-nitride semiconductor layer deposited over the active layer made of III-nitride semiconductor, and a p-side electrode deposited over the p-type III-nitride semiconductor layer, the light emitting device comprising:

a first layer composed of a carbon-containing compound layer, the first layer interposed between the p-type III-nitride semiconductor layer and the
10 p-side electrode and grown on the p-type III-nitride semiconductor layer; and

a second layer composed of a III-nitride semiconductor layer, the second layer grown after the first layer is grown.

2. The III-nitride compound semiconductor light emitting device of
15 claim 1, wherein the second layer is composed of a plurality of islands.

3. The III-nitride compound semiconductor light emitting device of claim 1, wherein the first layer is one selected from the group consisting of silicon carbide (Si_aC_b ; $a, b \neq 0$), silicon carbon nitride ($\text{Si}_c\text{C}_d\text{N}_e$; $c, d, e \neq 0$) and
20 carbon nitride (C_fN_g ; $f, g \neq 0$).

4. The III-nitride compound semiconductor light emitting device of claim 3, wherein the n-type III-nitride semiconductor layer, the active layer made of III-nitride semiconductor, the p-type III-nitride semiconductor layer, and the second layer is composed of $\text{Al}(x)\text{Ga}(y)\text{In}(1-x-y)\text{N}$ ($0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq x+y \leq 1$), and wherein the second layer is grown in a form of a plurality of islands due to different material characteristics between the first layer and the second layer.

5. The III-nitride compound semiconductor light emitting device of claim 3, wherein the second layer is a p-type III-nitride semiconductor layer.

6. The III-nitride compound semiconductor light emitting device of claim 4, wherein the second layer is made of a p-type $\text{Al}(x)\text{Ga}(y)\text{In}(1-x-y)\text{N}$ ($0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq x+y \leq 1$).

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7. The III-nitride compound semiconductor light emitting device of any one of claims 3 to 6, wherein the first layer is in a thickness of 5 Å to 1000 Å.

8. The III-nitride compound semiconductor light emitting device of any one of claims 3 to 6, wherein the growth temperature of the first layer is 500 °C to 1,100 °C.

9. The III-nitride compound semiconductor light emitting device of any one of claims 3 to 6, wherein the first layer is a p-type carbon-containing compound layer.

5 10. The III-nitride compound semiconductor light emitting device of any one of claims 3 to 6, wherein the first layer is an n-type carbon-containing compound layer.

10 11. The III-nitride compound semiconductor light emitting device of any one of claims 3 to 6, wherein the first layer is formed as a nonuniform layer.

12. The III-nitride compound semiconductor light emitting device of any one of claims 3 to 6, wherein the first layer is formed as a uniform layer.

15 13. The III-nitride compound semiconductor light emitting device of any one of claims 3 to 6, wherein the second layer is in a thickness of 100 Å to 5000 Å.

20 14. The III-nitride compound semiconductor light emitting device of claim 6, further comprising:

a third layer made of $\text{Al}(x)\text{Ga}(y)\text{In}(1-x-y)\text{N}$ ($0 \leq x \leq 1$, $0 \leq y \leq 1$,

$0 \leq x+y \leq 1$) and grown after the second layer is grown.

15. The III-nitride compound semiconductor light emitting device of claim 14, wherein the third layer is in a thickness of 5 Å to 200 Å.

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16. The III-nitride compound semiconductor light emitting device of any one of claims 3 to 6, wherein the p-side electrode is made of any one selected from the group consisting of nickel, gold, silver, chrome, titanium, platinum, palladium, rhodium, iridium, aluminum, tin, ITO, indium, tantalum, 10 copper, cobalt, iron, ruthenium, zirconium, tungsten, and molybdenum.

17. The III-nitride compound semiconductor light emitting device of claim 3, wherein the silicon source for growing the first layer is any one selected from the group consisting of SiH_4 , Si_2H_6 , and DTBSi, the carbon 15 source for growing the first layer is any one selected from the group consisting of CH_4 , C_2H_4 , and CBr_4 , and the nitrogen source for growing the first layer is any one selected from the group consisting of NH_3 , and Hydrazine-based source material.

20 18. A III-nitride compound semiconductor light emitting device comprising:

a substrate 10;

a buffer layer 11 deposited on the substrate 10;

an n-type $\text{Al}(x)\text{Ga}(y)\text{In}(1-x-y)\text{N}$ ($0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq x+y \leq 1$) layer 12 deposited on the buffer layer 11;

an $\text{Al}(x)\text{Ga}(y)\text{In}(1-x-y)\text{N}$ ($0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq x+y \leq 1$) active layer 13 deposited on the n-type $\text{Al}(x)\text{Ga}(y)\text{In}(1-x-y)\text{N}$ ($0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq x+y \leq 1$) layer 12;

an p-type $\text{Al}(x)\text{Ga}(y)\text{In}(1-x-y)\text{N}$ ($0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq x+y \leq 1$) layer 14 deposited on the $\text{Al}(x)\text{Ga}(y)\text{In}(1-x-y)\text{N}$ ($0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq x+y \leq 1$) active layer 13;

a first layer 20 made of one selected from the group consisting of silicon carbide (Si_aC_b ; $a, b \neq 0$), silicon carbon nitride ($\text{Si}_c\text{C}_d\text{N}_e$; $c, d, e \neq 0$) and carbon nitride (C_fN_g ; $f, g \neq 0$), and grown on the p-type $\text{Al}(x)\text{Ga}(y)\text{In}(1-x-y)\text{N}$ ($0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq x+y \leq 1$) layer 14;

a second layer 21 made of p-type $\text{Al}(x)\text{Ga}(y)\text{In}(1-x-y)\text{N}$ ($0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq x+y \leq 1$), composed of a plurality of islands for increasing external quantum efficiency, and grown after the first layer 20 is grown;

a p-side electrode 17 deposited on the second layer; and,

an n-side electrode 18 deposited on the n-type $\text{Al}(x)\text{Ga}(y)\text{In}(1-x-y)\text{N}$ ($0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq x+y \leq 1$) layer 12.

19. The III-nitride compound semiconductor light emitting device of

claim 18, wherein the p-type $\text{Al}(x)\text{Ga}(y)\text{In}(1-x-y)\text{N}$ ($0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq x+y \leq 1$) layer 14 and the second layer 21 made of p-type $\text{Al}(x)\text{Ga}(y)\text{In}(1-x-y)\text{N}$ ($0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq x+y \leq 1$) are made of GaN.

- 5 20. The III-nitride compound semiconductor light emitting device of claim 18, wherein the light emitting device is a light emitting diode.